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ABSTRACT

In this study, the teaching strategies of mothers of 14 gifted preschoolers were compared with the teaching styles of mothers of 14 nongifted children of the same age. Mothers were individually observed and videotaped while teaching three problem-solving tasks to their children. These videotaped interactions were then coded according to the structuring and elaborative strategies used by both mothers and children. Results indicated that mothers of gifted preschoolers helped their children structure the tasks as goal-directed operations, highlighted perceptual and functional cues to aid feature detection, and encouraged metacognition to a greater extent than did mothers of children in the nongifted sample. Gifted children displayed greater comprehension of rules, subgoals, and functional relations among objects; in addition, they used metacognitive strategies to regulate their behavior more frequently than did nongifted preschoolers. Both teaching and learning strategies varied according to the structure of particular tasks. (Author/MP)

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Mothers and Gifted Preschoolers Teaching and Learning Strategies[1]

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Abstract

In this study, the maternal teaching strategies of mothers of 14 gifted preschoolers were compared with the teaching styles of mothers of 14 nongifted children of the same age. Mothers were individually observed teaching three problem-solving tasks to their children. These videotaped interactions were coded according to the structuring and elaborative strategies used by both mothers and children.

Results indicated that mothers of gifted preschoolers helped their children structure the tasks as goal-directed operations, highlighted perceptual and functional cues to aid feature detection, and encouraged metacognition to a greater extent than mothers of the nongifted sample. The gifted children displayed greater comprehension of rules, subgoals and functional relations among objects, and used metacognitive strategies to regulate their behavior more frequently than the nongifted preschoolers. Both teaching and learning strategies varied according to the structure of particular tasks. Further studies should attempt to specify how parental teaching strategies may interfere or encourage the use and accessibility of those capacities the child possesses at different stages of development.

A number of studies have investigated the effects of parental teaching behavior on children's intellectual and academic development (Bercovici and Feshbach, 1974; Hess and Shipman, 1968; Wertsch, McNamee, McLane and Budwig, 1980). The results have suggested certain relationships between maternal teaching styles and children's information-processing strategies. Although much of the previous research has implied a relationship between the instructional strategies which parents are using and the problem-solving ability of their children (Jacobs, 1971; Steward and Steward, 1974), the question has not been formulated in terms which clearly delineate the teaching and learning processes involved in parent-child interaction. Researchers have tended to focus on global variables such as ethnicity (eg. Laosa, 1978) and socio-economic status (eg. Bee van Egeren, Streissguth, Nyman and Leckie, 1969) as overall mediating influences in the interactional process. Moreover, the child's learning style has too often been neglected as an observational variable. Few studies have explained how the child's cognitive processing may be affected by different teaching strategies. It is unclear how such strategies may interact with the young child's memory capacities, attention skills, logical reasoning and other elements of cognition. Current theoretical models of cognitive processing (Case 1978, Siegler, 1978) suggest that instructional strategies which emphasize rule induction, strategy modeling and cue highlighting may accelerate young children's acquisition of cognitive skills. An implication of experimental studies which demonstrate that certain instructional strategies are capable of accelerating preschoolers' learning of various cognitive tasks (Bem, 1970; Denney and Turner, 1979; Pellegrini, 1980) is that effective parental teaching strategies may have similar facilitative results. While several studies have shown that there are differences in the teaching styles of mothers of children at risk for cognitive

deficit and mothers of normal children (Levenstein, 1979; Steinert, 1976) few studies have adequately explored whether differences exist between the styles of mothers of children of superior intellectual ability and those of mothers of other children. Accordingly, an investigation of the interactive behavior of highly competent preschool children and their mothers may enhance our understanding of cognitive development.

Previous studies have tended to underestimate the importance of the problem-solving task to both the teaching and learning process. The task-analytic approach which is being increasingly recognized as an important tool in recent experimental literature (Resnick, 1976; Vliestra,1978)has all but been ignored by investigators of parent-child interaction. Intrinsic to our understanding of what kinds of operations the child engages in while performing a complex task is an analysis of these tasks in terms that make contact with recent psychological and developmental constructs. The identification of the component processes involved in task solution is a prerequisite to understanding what teaching strategies may effectively generate the process.

Accordingly, this study examined the teaching behavior of mothers of preschool gifted children in relation to the individual learning styles of their offspring. The context of the investigation was a series of problem-solving tasks in which both parent and child participated. In addition to both the instructional strategies of the parent and learning behavior of the child, the structure of the various tasks was considered as a contributing variable to the teaching-learning process. This study had the following principal objectives:

1) To compare the teaching strategies of mothers of gifted and nongifted preschool children with regards to such variables as problem structuring, cue highlighting and encouragement of metacognition.

2) To compare the learning strategies of gifted and nongifted preschool children in terms of conceptual and perceptual discrimination of object attributes

and metacognitive strategies such as predicting consequences, checking results and reality testing.

3) To investigate the effect of task structure on mother-child interaction - the identification of the component processes involved in task solution (task analysis) is a prerequisite to understanding what instructional strategies may accelerate the learning process.

4) To examine the relations between teaching and learning strategies for mothers and gifted children and for mothers and nongifted children to identify differing patterns of interaction.

Method

Subjects:

The final sample of 28 mother-child pairs was selected from an initial pool of 150 three to four year old children who had been tested on the Stanford-Binet Intelligence Test (Terman and Merrill, 1973). From this larger group 20 gifted (Binet IQ scores greater than 130) and 20 nongifted (Binet IQ scores between 100 and 120 were identified for further testing. These 40 children completed the following battery of tests:

1. The Block Design and Mazes subtests of the Wechsler Preschool and Primary Scale of Intelligence or WPPSI (Wechsler, 1967) to assess nonverbal, spatial-perceptual reasoning ability.
2. The Verbal Memory subtest of the McCarthy Scales of Children's Abilities (McCarthy, 1972) to evaluate short-term memory for auditory stimuli.
3. The Reading Recognition and Mathematics subtests of the Peabody Individual Achievement Test or PIAT (Dunn & Markwardt, 1970) as indices of reading and mathematics skills.

It has been well-emphasized (Martinsen, 1977) that the best identification systems for selecting gifted children combine a variety of complementary procedures. According to Roedell, Jackson and Robinson (1979), the combination of the above measures of spatial-perceptual reasoning skill, short-term memory, mathematics, and reading ability with the Binet provide a valid and comprehensive evaluation of particular skills and general intellectual ability in preschool children. The final sample of gifted children consisted of 14 three and four year old children who had obtained outstanding scores (two standard deviations above the mean) on one or more of the above tests in addition to a Binet IQ score greater than 130. The final nongifted sample was composed of 14 preschoolers who had obtained average scores on all tests. Mothers of the two groups did not differ significantly with respect to age, occupation, & educational level. All children included in the sample were the natural offspring of intact families in which mothers were employed outside the home on no more than a part-time basis. None of the children attended preschool programs for more than 2½ hours per day. Hence, all mothers participating in the study were the primary caretakers of their children. The two groups differred significantly with respect to father's educational level (F (1,28) = 8.83, $p < .01$) and scores on the PIAT Reading (F (1,28) = 9.97, $p < .01$), PIAT Math (F (1,28) = 13.03, $p < .01$) and WPPSI Block tests (F 1,28) = 13.94, $p < .01$). Means and standard deviations for the sample on demographic and cognitive measures are found in Table I.

Insert Table 1 about here

Procedure:

All screening measures were administered in the child's home usually during two sessions after written permission was received from participating mothers. For the third session, mothers were asked to bring their children to a private

apartment centrally located in the Montreal area. Each mother-child pair was separately observed while engaged in three different problem-solving activities, a puzzle task, a peg game and a block design task.

Each of the tasks selected called for different types and degrees of teaching activities, such as information-giving and structuring. As well, the tasks were designed to elicit varying amounts of independent activity from the children. In addition, each task had to be sufficiently novel and interesting so that the children would be motivated to perform it. Each task selected had to be meaningful and suited to the abilities of the preschool child. Tasks were sufficiently difficult to generate at least some form of teaching behavior on the part of the mothers and to obtain comparable data for all the children. At the outset of each task, mothers were instructed to do the tasks with their children, helping them as much or as little as they felt was necessary. The adult and child worked on each task for 10 minutes. Order of task presentation was unvaried for all subjects. All sessions were videotaped and audiotaped by an observer who was already familiar to subjects since he had previously tested the children in their homes.

Coding Methodology

Maternal teaching strategies and child behavior variables were coded from videotaped segments according to predefined behavior categories. These behavior categories were derived from information-processing models of learning and instruction (Klahr, 1976; Siegler, 1978; Farnham-Diggory, 1976) as well as previous research on the subject of mother-child interaction (Bee et al. 1969; Steinert, 1976). The coding system was pretested and revised before the collection of final data. In order to establish reliability, two coders blind to the group membership of subjects coded each taped interaction. Both the

mother and child coding systems are divided into three major categories of instructional and learning variables i.e. structuring, elaborative and regulatory strategies. The definitions of behavior categories (with interobserver agreement in parentheses) are presented below.

Maternal Teaching Strategy Variables

Structuring Variables

Goal Structuring (87%) - Outlines or asks child to provide overall aim of the problem-solving task.

Subgoal Structuring (84%) - Outlines or asks child to state an intermediate stage of problem solution.

Rule Structuring (82%) - Outlines or asks child to state constraints within which the problem solver should proceed.

Structuring Physical Help (88%) - Accomplishes physical movement which helps structure the task for the child but still requires him to find solution by himself.

Gives Solution (86%) - Tells child to do a specific action which will lead to solution of a particular subgoal or accomplishes this action herself.

Elaborative Strategies

Perceptual Cue Highlighting (91%) - Helps the child to detect perceptual features of objects eg. size, color, shape which offer cues to problem solution.

Functional Cue Highlighting - Helps the child to note functional associations between objects by offerring contextual cues (89%) or including in narrative sequences (83%)

Labeling (87%) - Names objects & encourages child to do so

Encourages Manipulation (87%) - Directs child to explore his own solutions by handling objects in a trial and error fashion.

Multiple-Cue Statements (89%) - Describes several object attributes simultaneously within a statement eg. a curvy red piece.

Regulatory Strategies

Affective Positive Feedback (88%) Positive feedback which is contingent upon task performance and which contains an emotive element of approval (Steinert, 1976)

Informational Positive Feedback (86%) - Positive feedback which indicates to the child that he has responded correctly but which contains no emotive element of approval (Steinert, 1976)

Negative Feedback (90%) - Negative feedback which is contingent upon task performance and which indicates to the child that he has not responded correctly (Steinert, 1976.)

Disapproval (89%) - Disapproving statement which indicates displeasure but does not offer information relevant to the particular task.

Metacognitive Regulatory Strategies

Encourages child to predict consequences of future actions (86%)

Encourages child to check results of already accomplished actions (84%)

Encourages child to monitor the ongoing activity (83%) - Helps child to judge the appropriateness of his problem-solving attempts in terms of available resources such as time and materials.

Encourages child to reality test (85%) - Helps child to match his own discriminations of his abilities or of external events against adult conceptions.

Directive Monitoring Strategies (87%) - Behaviorally rather than cognitively - oriented statements or questions (often rhetorical) which are aimed at getting child's attention.

Child Behavior Variables

Structuring Strategies

Goal Structuring (87%) - Identifies overall aim of problem-solving activity

Subgoal Structuring (85%) - Identifies an intermediate stage of activity

Rule Structuring (83%) - Outlines constraints within which activity must proceed.

Requests help (89%) - Child asks for direction without specifying a particular aspect of the problem-solving process.

Elaborative Strategies

Perceptual Cue-Highlighting (91%) - Child notes perceptual feature of object i.e. color, size, or shape.

Functional Cue Highlighting - Child notes contextual associations of objects (89%) verbalizes a narrative sequences involving object attributes (83%)

Labeling (91%) - Child names object

Manipulation (84%) - Child handles objects in a trial and error fashion.

Multiple Cue Statements (86%) - Child simultaneously identifies two or more object attributes within one statement.

Metacognitive Regulatory Strategies

Child Predicts Consequences of a Future Action or Event (86%).

Child Checks Results of an Already Accomplished Action (84%)

Monitors Ongoing Activity (83%) - Child verbally judges appropriateness of his problem-solving attempts in terms of available resources such as time and materials.

Reality Tests (83%) - Child verbally matches his own discriminations of his abilities or of external events against adult conceptions.

Results

In order to have an overall perspective on differences between gifted and nongifted groups, observational variables were combined within structuring, elaborative and regulatory categories. Each main category was analyzed using a 2-way analysis of covariance model with repeated measures. Factors were type (gifted or nongifted) and task (puzzles, pegs or blocks). The covariate was total number of verbal statements for each subject. Covariance analysis was used in order to control for differences in general verbal ability between groups. In order to have specific information on the contribution of mother and child groups, separate analyses were carried out for each group. When indicated by significant factor levels, post hoc comparisons (Duncan Multiple Range Tests) were carried out in order to further examine differences between means.

As a second step, each individual observational variable was analysed using the same 2 x 3 analysis of covariance.

Finally, in order to compare the interactional patterns of gifted and nongifted groups, Pearson product-moment correlations were computed between teaching and learning strategy variables for each group. Correlation matrices were compiled respectively for both subgrouped and individual mother and child variables.

In response to the first research question of this study, results show significant differences in the teaching strategies used by mothers of gifted and nongifted preschoolers. Table 2 presents the means and standard deviations of maternal variables for both groups. Greater variability between the two

Insert Table 2 about here

groups existed with respect to overall elaborative (F (1,28) = 15.23, $p < .01$) and regulatory strategies (F (1,28) = 23.68, $p < .01$) than to structuring activity. Two kinds of structuring activity, solution-giving and goal-setting, were employed to differing extents by mothers. Mothers of gifted children spent considerably more time relating parts of the task problem to its end-goal (F (1,28) = 6.08, $p < .05$). Mothers of nongifted children were less involved in developing a solution path with their children and frequently offered solutions (F (1,28) = 37.23, $p < .01$). No differences were noted in delineation of subgoals, rules or structuring physical help.

With respect to eleborative strategies, mothe. s of gifted children more frequently highlighted perceptual (F (1,28) = 4.18, $p < .01$) and functional cues (F (1,28) = 14.13, $p < .01$) to facilitate the storage and retrieval of information. In addition to focusing their children on physical object attributes, mothers of gifted children more often associated concepts with narrative sequences (F (1,28) = 6.87, $p < .01$) and provided information on the context of moves (F (1,28) = 6.18, $p < .01$). Mothers of gifted children fostered their preschoolers' recognition of several relevant object features simultaneously by more frequently using multiple-cue statements (F (1,28) = 9.24, $p < .01$). No differences between the mother groups were noted in the encouragement of labeling activity, or object manipulation.

Mothers of gifted children employed regulatory strategies to a greater extent than the comparison group. They gave more positive affective feedback (F 1,28) = 22.54, $P < .01$) and helped their children to engage in self-regulatory metacognitive activities. Mothers of gifted preschoolers more frequently encouraged their offspring to judge the appropriateness of moves by predicting consequences (F (1,28) = 10.68 $P < .01$) and reality testing (F (1,28) = 11.04, $P < .01$). By more frequently drawing the child's attention to the coordination

processes involved in the problem-solving activity (F (1,28) = 19.57, $P < .01$), mothers helped their gifted children to monitor their own cognitive processing. Mothers of nongifted children used more negative reinforcement (F (1,28) = 7.62, $P < .01$), disapproval (F (1,28) = 4.06, $P < .05$), and directive monitoring strategies (F (1,28) = 4.57, $p < .05$). No differences were noted in the use of informational positive feedback, or in checking results.

The second research question concerned differences in the learning strategies of gifted and nongifted preschoolers. Analysis of covariance results for child variables reveal that gifted children used significantly more structuring (F (1,28) = 4.26, $p < .05$), elaborative (F (1.28) = 4.69, $p < .05$), and regulatory (F, (1,28) = 16.22, $p < .01$) learning strategies than did nongifted children. Means and standard deviations for both groups of children are presented in Table 3.

Insert Table 3 about here

In terms of individual structuring variables, gifted children verbalized more rules than did their nongifted peer group (F (1,28) = 11.72, $P < .01$). No differences were noted in enumeration of goals, subgoals or number of questions. The overall tendency for gifted children to use more elaborative strategies was not reflected by analysis of covariance results on any individual elaborative variables. Although examination of Table 3 reveals considerable differences in the mean values of learning variables for gifted and nongifted children, the influence of the covariate (total number of verbal statements) probably accounts for the lack of significant findings. The gifted children's greater verbal ability accounts for much of the difference on specific learning strategy variables.

A most interesting finding is the greater prevalence of metacognitive strategies in the problem-solving behavior of gifted preschoolers (F (1,28) = 16.22, $p < .01$). They consistently compared their own designs with imagined real-life models (reality testing) (F (1,28) = 7.77, $p < .01$) and engaged in self-monitoring coordination activities (F (1,28) = 3.91, $p < .05$) to greater extent than did nongifted children. Metacognitive strategies exert an executive control function

on other cognitive processes such as memory and attention and thus play a quintessential role in intelligent behavior.

The third research question in this study concerns the influence of task structure on interactional processes. Analysis of covariance results demonstrate a significant difference between tasks for both subgrouped teaching and learning strategy variables. Task means for mother and child variables are reported in Table 4.

Insert Table 4 about here

Duncan multiple range tests of differences among means reveal that the greatest amount of structuring teaching activity was associated with the peg game (F (2,28) = 48.65, $p < .01$), the task identified by the task analysis as most structured. Elaborative and regulatory teaching activity were significantly more prevalent on both the puzzle and peg game than on the block design task (F (2,28) = 11.21, $p < .01$) for elaboration; (F (2.28) = 28.77, $p < .01$) for regulation. In addition, significant differences between tasks were noted for child learning strategy variables. Parallel with maternal patterns, children's structuring activity was most frequent on the peg game (F (2,28) = 4.60, $p < .01$). Elaborative learning strategies were most prevalent on the peg game task as well (F (1,28) = 5.63, $p < .01$). No significant task differences were noted for overall regulatory learning strategies.

Correlational analyses between teaching and learning strategies presented in Tables 5 and 6 reveal differing patterns for gifted and nongifted mother-child pairs.

Insert Tables 5 and 6 about here

For the gifted group, mother' subgoal, rule-structuring, interrogative behavior and directive monitoring strategies are related to child's rule-structuring.

In addition, mothers' contextual cue highlighting, encouragement of checking results and prediction of consequences are related to gifted children's contextual elaboration. For the nongifted group, interrogative behavior, reality testing and directive monitoring strategies are related to child's perceptual elaboration. As well, mother's interrogative behavior, labeling, disapproval and directive monitoring strategies are related to child's labeling. Thus, for the gifted sample, structuring, elaborative and metacognitive teaching strategies are more strongly related to child rule-structuring and contextual elaboration. For the nongifted sample, structuring, labeling, and regulatory strategies are more strongly related to child perceptual elaboration and labeling.

Discussion

The results of this study have revealed notable differences between the teaching strategies of mothers of preschool children of superior intellectual ability and those of mothers of average preschoolers. Moreover, comparison of the learning strategies of the children themselves has revealed notable differences in their approaches to problem-solving situations. A growing body of experimental literature suggests that concept development, rule learning, and strategy progression can be accelerated by instructional techniques which emphasize goal structuring, alternative solution thinking, and cue highlighting. The results of this study support this hypothesis in the sense that mothers of gifted preschoolers demonstrated these instructional techniques to a greater extent than did mothers of nongifted preschoolers.

The most striking differences between the two groups of mothers, in terms of individual teaching strategies related to problem structuring, were observed in goal management and solution giving. Mothers of gifted children spent considerably more time in relating parts of the task problem to its end goal. Mothers of nongifted children were more directive in their teaching activity in the sense that they more frequently offered solutions in the course of

problem-solving activities. While the disadvantage of overly directive teaching methods has been well documented in the literature as limiting the child's exploration of the task (Bee et al., 1969; Bercovici & Feshbach, 1974; Hess & Shipman, 1965), the advantages of the goal structuring approach are less well known. References to the experimental work of Vliestra (1978), Bem (1970) and others is helpful in understanding these differences. Vliestra's (1978) comparative study of the effectiveness of different instructional strategies indicated that training in a selective attending strategy which related parts of the task to its end goal was most effective in minimizing distraction by dominant, irrelevant perceptual cues. Kreutzer, Leonard and Flavell (1975) have pointed out that young children rarely use deliberate plans to remember. This suggests the necessity to outline the goal and subgoals of a problem-solving activity in order to lead the child to attend to relevant semantic features and interrelations between successive steps. Instructions which contain too much information may tax the young child's very limited short-term-memory span (Rohwer & Dempster, 1978) This may result in errors in problem-solving performance regardless of the strategies that may be available to the child. Directing the child in operations one step at a time as well as frequent repetition of rules, goals, and subgoals may avoid improficiency due to short-term-memory failure. Moreover, as Bem (1970) explains, it is first necessary for the child to comprehend the structure of the problem before discovering what verbalization to produce. Constructing an internal representation of the problem involves a kind of means-end-analysis hinging on a clear representation of the desired goal.

Mothers of gifted children highlighted perceptual and functional cues more often than the comparison group. The finding that mothers of gifted preschoolers engaged in more elaborative activity than did mothers of nongifted children has a number of interesting implications. Rohwer (1973) has defined

elaboration as "the generation of an event that jointly implicates two or more items that are initially disparate" (p.276). Campione and Brown (1978) have explained the goal of elaborative strategies as the creation of a meaningful context in which to imbed items. These relational contexts serve as multiple access routes to memory through the particular modality of cues that they represent (e.g., verbal, imaginal, sensory, context of occurrence) (Paris & Lindauer, 1978). The inability of preschoolers to employ spontaneous elaboration strategies other than manipulation or frequent looking has been well-documented (Kail & Hagen, 1977; Resse, 1977; Rohwer & Dempster, 1978). Hence, a prime function of instruction for this age group is the highlighting of cues which can be stored in relational networks and used in aiding retrieval.

Evidence from studies which have investigated the encoding of item identity information (Ghatala, 1970; Hasher & Clifton, 1974) demonstrate the propensity for young children to ignore semantic features in favor of salient perceptual dimensions. Moreover, Case (1978) has pointed out that preschoolers fail to code all relevant perceptual dimensions due to limited short-term-memory capacity. By highlighting additional cues for the child, the instructor can substantially reduce the load on short-term memory. Case further suggests that such instruction may even reduce the age at which a given executive structure is acquired. Whereas simple exposure to problem-solving situations coupled with feedback is important for normal cognitive development, cue highlighting and strategy modeling may accelerate strategy evolution in young children.

Those strategies which are loosely considered here as "regulatory" are those which the child or the instructor uses to keep on task or maintain the problem-solving sequence. Such strategies are essentially sources for the ongoing evaluation of performance. In this study, two major categories of regulatory strategies were investigated. Feedback categories represented

external attempts to evaluate the children's behavior while metacognitive teaching strategies were used when the mothers sought to encourage their children to analyze and regulate their own thinking and action processes. Although mothers of gifted and nongifted children used a combination of feedback and metacognitive teaching strategies, striking differences existed in the degree to which specific types of regulatory strategies were employed. Mothers of the gifted group were far more inclined to give positive affective feedback than were mothers of the nongifted group. Negative feedback and disapproval were strategies used more often by the mothers of the nongifted group. As well, they more frequently used behavioral monitoring techniques. Case (1978) has discussed the importance of giving the child feedback regarding goal attainment in order to facilitate strategy evolution. Siegler (1978) has demonstrated that encoding training coupled with feedback is an effective strategy for teaching simple rules to 3-year-olds. The utility of different kinds of feedback has been discussed extensively in the literature (Baer & Wolf, 1968; Bruner, 1966).

Of much greater theoretical impact in furthering our knowledge of cognitive development is a consideration of the data on metacognition obtained in this study. The cluster of variables which most consistently differentiated the teaching behavior of mothers of gifted and nongifted children were those representing encouragement of metacognitive skills. Mothers of gifted children asked their preschoolers to predict the consequences of their actions, and reality test significantly more often than did the comparison group. Recent studies (Baker & Brown, 1980, Flavell & Wellman, 1977) have confirmed the greater prevalence of metacognitive activity on the part of experts versus nonexpert performers in such areas as reading, memory and communication. Very few studies have identified the existence of metacognitive skills in very young children or have investigated the teaching of these skills. Results of this

study suggest that mothers of gifted children as young as 3 years old encourage the development of metacognition in their offspring. These findings are especially relevant to contentions made by researchers such as Brown (1978) and Resnick and Glaser (1976) that metacognitive skills are the essence of intelligent activity, since they encompass abilities involved in learning without formal instruction. Although more complex metacognitive skills such as the ability to reflect on one's own cognitive processes are more typical of the older child (Baker & Brown, 1980), simple metacognitive behaviors are evident even in the preschool child.

Moreover, this study has contributed to our understanding of qualitative aspects of high intellectual ability. An implicit assumption throughout the project has been the multidimensionality of intelligence. The ability level of the children selected for the project was determined by their performance an spatial, perceptual, memory, mathematics, and prereading tasks as well as on IQ measures. The results of the study demonstrate correlations between problem-solving ability and high IQ. The gifted children in our sample showed an unsual awareness of how to analytically structure problems. They understood functional attributes of objects at an age far earlier than expected. Their metacognitive functioning (i.e., reality testing, activity monitoring, predicting consequences) appeared to be more highly developed than that of their nongifted peers. The depth of the cognitive processing underlying such behavior is remarkable for a child of 3 or 4 years old. Yet the tendency to analyze the semantic attributes of objects, to integrate these conceptual features and express the semantic integration verbally was typical of many of the gifted preschoolers observed in this study. This study has demonstrated that task structure has a significant influence on mother-child interaction. There is considerable variability in the types and extent of

structuring, elaborative and regulatory activity used on different tasks. This finding highlights the importance of task analysis as a research tool to identify the information structures required for performance and to describe the cognitive processes and strategies that need to be applied to the information.

Interrelations between mother and child observational variables can help our understanding of the different patterns of mother-child interaction in the gifted and nongifted samples. For the gifted sample, mothers subgoal and rule structuring, interrogative behavior and directive monitoring strategies are related to child's rule structuring. Denney, Zeytinoglu and Seltzer (1978), Siegler (1978) and Case (1978) have discussed the importance of strategy modeling and analytic structuring behavior in encouraging rule adoption in the preschool child. It is also possible that the greater ability of gifted children to enumerate rules than their nongifted peer group elicited more strategy modeling from their parents. Similarly, the relation between mother's interrogative behavior, labeling, disapproval and directive monitoring strategies and nongifted children's labeling has alternative explanations. Mothers' asking children to name items elicited labeling activity from their offspring. Children's unsuccessful attempts at naming items evoked disapproving comments and behavioral focusing from parents. For the gifted group, mothers' goal structuring was related to the children's reality testing; for the nongifted group, mothers' goal verbalization was related to children's verbalization of goals and subgoals. On the block-design task, the gifted children's discussion of ways to integrate elements into viable structures was encouraged by their mothers' encouragement of goal analysis and vice-versa. The intermediary metacognitive stage was less prevalent in the interaction of mothers and nongifted children. Correlations between elaborative and regulatory teaching and learning strategies suggest that mothers and gifted children used both

perceptual and functional elaboration in solving problems while mothers and nongifted children used only perceptual elaboration. Prawat and Wildfong (1980) suggest that while 2½ to 5 year old children respond more to perceptual attributes of objects than to functional characteristics, the opposite relation holds true for older children. Our results imply that gifted preschool children show a sensitivity to functional attributes which resembles the cognitive activity of 7 and 8 year old children. Moreover, the ability to switch between perceptual and functional elaborative techniques displayed in the mother-gifted child interactional pattern is indicative of a flexible-thinking pattern. The ability to think flexibly and hold several divergent ideas in consciousness at once appears to be a skill which characterizes highly successful adult learners (Shore, Hymovitch, & Lajoie, 1982). For mothers and nongifted children, comparing and contrasting of object features was mainly directed at perceptual elaboration.

Conclusion

This study has differed from most research on maternal teaching behavior which has examined socioeconomic,ethnic, and ability factors in static models independently of situational demands or information-processing abilities of the child. In this study, parent-child interaction has been viewed as the developmental context for the emergence of information-processing skills in young children. Further studies on maternal teaching strategies should focus more on the mental operations implicated in the interactional process. We need to understand the initial state of the child's competence in terms of the psychological processes he is capable of using, and the desired state of competence (i.e., the information structures required for performance) revealed by a task analysis. On this basis, we can predict which teaching strategies may help the child achieve the desired state of competence in terms of which cognitive strategies need to be applied to the information.

In order to test these hypotheses, we must also take account of different ability levels of both teacher and learner. There is a notable disregard for individual differences in the current experimental literature concerned with developmental cognitive psychology. If we are to understand how cognitive processing is related to intellectual development, we must study gifted children as well as average and less able populations based on IQ and other relevant criteria. Although there are several recent studies which have examined cognitive processing and strategy utilization in low-achieving populations (Brown, 1974; Parill-Burnstein, 1979), research of this nature with gifted children is sorely lacking.

Particularly relevant to the study of qualitative aspects of superior intellectual ability would be the further examination of metacognition in gifted people of all ages. Results from this study have suggested that the individual's metacognitive status is directly related to intellectual achievement and advanced problem-solving ability. This study investigated the self-regulatory mechanisms that even preschool children are capable of using in problem-solving situations. However, there are other metacognitive skills related to the ability to reflect on one's own activities (see Baker & Brown, 1980) which develop in older children. A main objective of the McGill Giftedness Project research team with which the author has been associated is to trace the development of metacognitive skill in individuals from its earliest manifestation to the adult level. Several of the cognitive skills which were encouraged by mothers of gifted preschool children in this study have remarkable parallels with learning strategies observed in highly successful adult learners. These parallels in structuring, elaborative and regulatory strategies between young gifted children and successful adult learners should be further explored. Moreover, the mechanisms through which these strategies are acquired should be further investigated. As Landa (1974) states, "The operations which a person performs

in the process of thinking are not innate and he must be specially taught to do them" (p.600). This study's finding that mothers of gifted preschoolers encourage specific structuring, elaborative and metacognitive strategies is worthy of further research. Such information is crucial to our understanding of the transition mechanisms which underlie cognitive development. Further studies should attempt to specify how parental teaching strategies may interfere or encourage the use and accessibility of those capacities the child possesses at different stages of development.

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Table 1

Means and Standard Deviations for Gifted and Nongifted Children on Demographic and Cognitive Measures

Variable	Gifted		Nongifted	
	Mean	SD	Mean	SD
Age	45.85	7.02	47.50	5.21
IQ	133.22	3.92	112.30	6.74
Father's Educational Level	17.57	2.41	15.15	3.89
Mother's Educational Level	14.00	3.24	14.86	4.06
PIAT Reading Recognition	16.07	5.25	11.36	3.10
PIAT Mathematics	12.64	3.99	9.14	3.48
WPPSI Block Design	7.36	2.62	5.21	1.81
WPPSI Mazes	4.86	3.01	3.86	2.38
McCarthy Verbal Memory	8.50	3.80	6.79	2.88

Table 2

Means and Standard Deviations of Teaching Variables for Mothers of Gifted and Nongifted Children

Category	Variable	Mothers of Gifted Mean	Mothers of Gifted SD	Mothers of Nongifted Mean	Mothers of Nongifted SD
Structuring Strategies		16.36	12.68	17.45	18.87
	Goal	1.17	1.17	0.57	1.27
	Subgoal	4.12	4.05	4.26	5.87
	Rule	2.17	4.29	1.60	3.32
	Physical Help	1.67	2.41	1.12	1.63
	Gives Solution	0.60	1.06	3.26	2.96
	Number of Questions	8.31	6.68	7.76	10.29
Elaborative Strategies		9.71	6.03	6.17	6.34
	Perceptual Cue	2.31	2.30	1.48	2.39
	Contextual Cue	1.62	1.95	0.79	1.79
	Narrative Cue	0.93	1.40	0.31	0.78
	Naming Cue	2.64	2.66	2.64	3.01
	Manipulation Cue	0.76	1.07	0.52	1.38
	Number of Multiple-Cue Statements	1.79	2.23	0.67	1.20
Regulatory Strategies		9.69	4.47	6.38	5.74
	Affective Positive Feedback	2.26	1.78	0.74	1.36
	Informational Positive Feedback	0.86	1.24	0.83	1.29
	Negative Feedback	0.31	0.64	0.86	1.59
	Disapproval	0.05	0.22	0.26	0.63
	Checks Results	0.86	1.11	0.93	1.85
	Monitors Activity	2.07	2.22	0.05	0.89
	Predicts Consequences	0.81	1.44	0.10	0.48
	Reality Tests	1.67	1.54	0.67	1.18
	Directive Monitoring Strategies	0.81	1.35	1.50	2.26

Table 3

Means and Standard Deviations of Learning Variables for Gifted and Nongifted Children

		Gifted		Nongifted	
Category	Variable	Mean	SD	Mean	SD
Structuring Strategies		3.60	3 86	2.26	3.48
	Goal	0.67	1.24	0.69	1.46
	Subgoal	1.30	2.07	0.83	1.64
	Rule	0.88	1.71	0.07	0.34
	Requests Help	1.41	0.90	1.43	1.01
	Number of Questions	0.74	0.98	0.76	1.79
Elaborative Strategies		5.55	3.60	4.24	3.44
	Perceptual Cue	1.00	2.00	0.86	1.72
	Contextual Cue	0.26	0.73	0.07	0.34
	Narrative Cue	0.69	1.22	0.79	1.46
	Naming Cue	0.55	0.97	0.52	1.06
	Manipulation Cue	3.61	2.85	2.69	3.00
	Number of Multiple-Cue Statements	0.12	0.40	0.10	0.48
Regulatory Strategies		2.36	3.33	0.60	0.83
	Checks Results	0.38	1.32	0.02	0.15
	Monitors Activity	0.69	1.35	0.24	0.62
	Predicts Consequences	0.38	1.53	0.10	0.30
	Reality Tests	0.90	1.43	0.24	0.53
Total Number of Statements		12.71	7.97	8.79	6.13

Table 4

Means and Standard Deviations of Maternal and Child

Subgrouped Variables for Three Tasks

		Mother		Child	
Category Subgroup	Task	Mean	SD	Mean	SD
Structuring	puzzles	8.00	5.58	1.32	2.00
	pegs	23.86	15.76	1.18	4.67
	blocks	9.75	6.48	1.75	2.25
Elaborative	puzzles	10.04	7.02	4.50	2.33
	pegs	8.79	6.48	6.68	3.75
	blocks	5.86	5.18	5.71	2.70
Regulatory	puzzles	8.50	5.17	1.75	3.18
	pegs	7.79	4.72	1.11	1.62
	blocks	4.36	3.55	1.57	2.70

Table 5

Interrelations between Subgrouped Teaching and Learning Strategy Variables for Mothers and Gifted Children

Mother Variables		Child Variables A	A1	A3	B	B1	E2	B3	C. or C
A	Structuring	0.29	0.24	0.01	0.16	0.25	-0.17	0.13	-0.21
A1	Goal-Rule-Subgoal	0.26	0.26	0.05	0.05	0.16	-0.23	0.08	-0.23
A2	Solution	0.26	-0.24	-0.24	-0.13	-0.04	-0.10	-0.16	-0.12
A3	Interrogative	0.30*	0.20	0.04	0.34*	0.35*	-0.04	0.30*	-0.16
B	Elaborative	-0.04	0.31*	0.19	0.30*	0.26	0.18	0.09	-0.12
B1	Perceptual	0.03	-0.23	0.21	0.20	0.20	0.10	0.03	0.11
B2	Functional	0.30*	0.40*	0.02	-0.15	-0.27	0.31*	-0.12	-0.12
B3	Labeling	0.27	0.07	0.07	0.42**	0.38**	0.05	0.34*	-0.26
C	Regulatory	0.12	0.00	0.05	0.19	0.40**	-0.04	0.15	-0.16
C1	Metacognitive	0.20	0.04	0.23	0.02	-0.01	0.05	0.05	-021
C2	Feedback	-0.03	-0.05	0.05	0.30*	0.40**	-0.14	0.07	-0.01
C3	Directive Monitoring	0.10	-0.16	0.07	0.04	0.18	0.00	-0.03	-0.20

*p < .05
**p < .01

Table 6

Interrelation Between Subgrouped Teaching and Learning Strategy Variables for Mothers and Nongifted Children

	Child Variables							
Mother Variables	A	A1	A3	B	B1	B2	B3	C1 or C
A Structuring	0.09	0.16	0.11	0.19	0.23	-0.23	0.26	-0.01
A1 Goal-Rule-Subgoal	0.03	0.17	0.03	0.23	0.22	-0.14	0.26	0.01
A2 Solution	0.15	-0.11	0.18	-0.08	0.03	-0.09	-0.14	-0.07
A3 Interrogative	0.07	0.17	0.08	0.18	0.15	-0.18	0.36*	-0.05
B Elaborative	-0.00	-0.03	0.05	-0.18	-0.18	-0.13	0.09	-0.13
B1 Perceptual	-0.07	-0.11	0.01	-0.28	-0.22	-0.23	0.02	0.04
B2 Functional	-0.11	-0.17	-0.04	-0.28	-0.26	0.02	-0.16	-0.22
B3 Labeling	0.13	0.15	0.07	0.05	-0.01	-0.07	0.29	-0.09
C Regulatory	-0.09	-0.08	0.03	0.04	0.17	-0.36*	0.15	-0.10
C1 Metacognitive	-0.21	-0.23	-0.12	0.12	0.22	-0.19	0.03	-0.22
C2 Feedback	0.08	0.11	0.18	-0.06	0.04	-0.39**	0.21	0.07
C3 Directive Monitoring	-0.01	0.01	0.02	0.21	0.39**	-0.30	-0.01	0.14

*$p < .05$
**$p < .01$